



## IN THE SOUTED STATES PATENT AND TRADEMARK OFFICE

Applicant:

CHOE, G.

Examiner:

Unknown

Serial No.:

10/038,125

Group Art Unit:

2652

Filed:

1/2/02

Docket No.:

SJO920010040US1

501.388US01

Title:

A METHOD AND APPARATUS FOR PROVIDING PRECISE

CONTROL OF MAGNETIC COUPLING FIELD IN NIMn TOP SPIN

VALVE HEADS AND AMPLITUDE ENHANCEMENT

## **CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8**

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on

Michael T. Wallace

Name

Signature

## **SUBMISSION OF FORMAL DRAWINGS**

Box Missing Parts Assistant Commissioner for Patents Washington, D.C. 20231 22865
PATENT TRADEMARK OFFICE

Dear Sir:

Enclosed herewith are eleven (11) sheet(s) of formal drawings for the above-referenced patent application in response to the communication dated February 1, 2002.

Respectfully submitted,

ALTERA LAW GROUP, LLC 6500 City West Parkway, Suite 100 Minneapolis, Minnesota 55344-7701 952-253-4127

Date: 4-1-02

Reg. No. 45,420

MTW/tmj

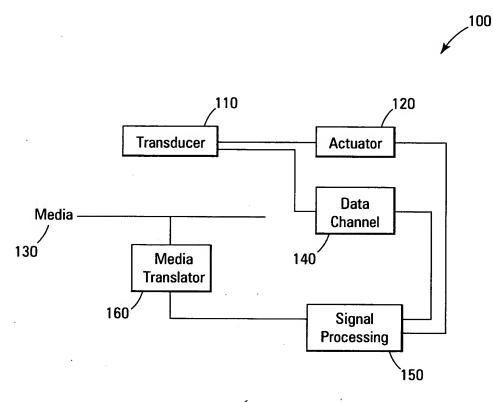
Inventor: Choe, G.

ETHOD AND APPORTUS FOR PROVIDING PRECISE CONTROL

FIELD IN NiMn

SPIN VALVE HEADS AND AMPLITUDE ELEMNCEMENT

Docket no.: SJ09-2001-0040US1 / 501.388US01 Serial Number 10/038,125



Inventor: Choe, G.

Title: A METHOD AND APT ATUS FOR PROVIDING PRECISE CONTROL MAGNETIC COUPLING
FIELD IN NIME SPIN VALVE HEADS AND AMPLITUDE EN NCEMENT
Docket no.: SJ09-2001-0040US1 / 501.388US01 Serial Number 10/038,125

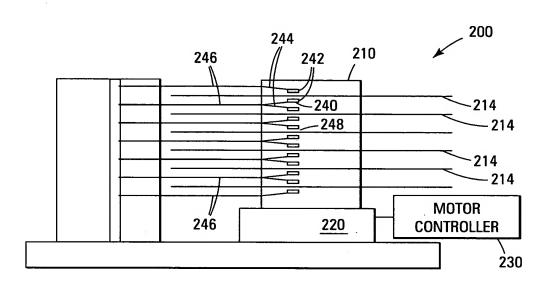
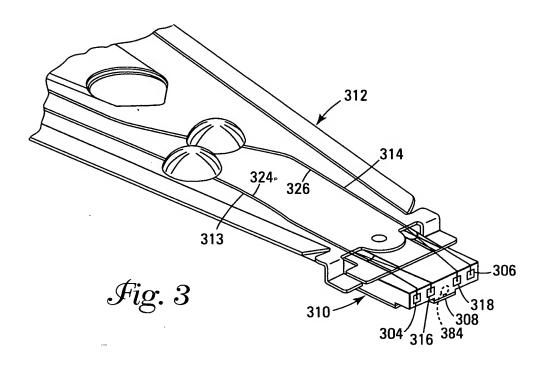
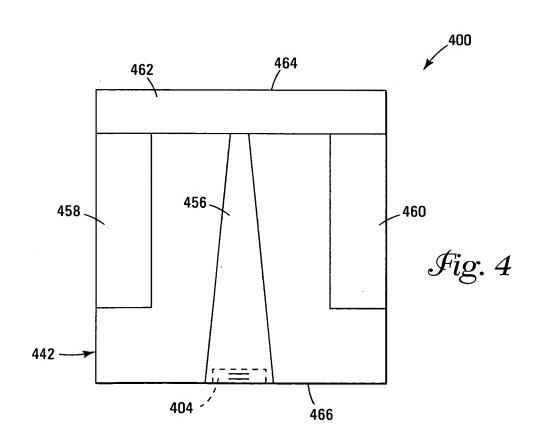


Fig. 2

MAGNETIC COUPLING NCEMENT

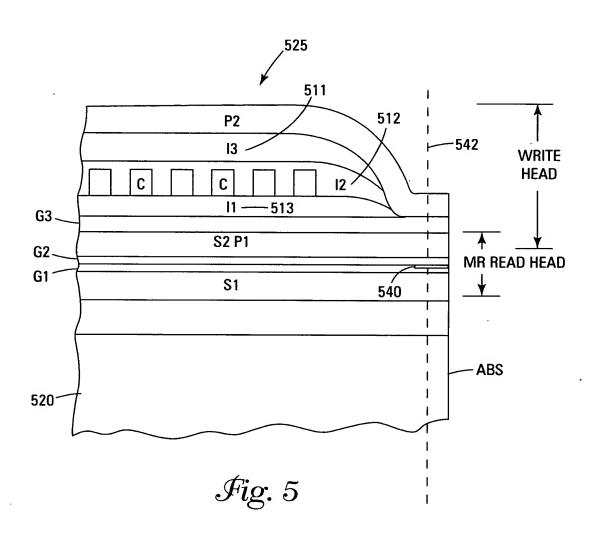
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MAGNETIC COUPLING NCEMENT

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FIELD IN NIME SPIN VALVE HEADS AND AMPLITUDE EN NCEMENT
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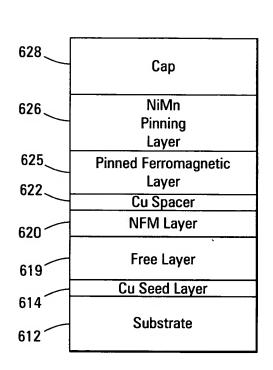


Fig. 6

Inventor: Choe, G.

Title: A METHOD AND APPARATUS FOR PROVIDING PRECISE CONTROL MAGNETIC COUPLING FIELD IN NIME P SPIN VALVE HEADS AND AMPLITUDE EXPANCEMENT Docket no.: SJ09-2001-0040US1 / 501.388US01 Serial Number 10/038,125

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	As-deposite	As-deposited free layer	Annealed free lay	Annealed free layer at 250°, 5 hrs
	λi	$\lambda_{b}$	λi	qγ
Without	$6 \times 10^{-5} \text{ Å}$	$-3.2 \times 10^{-6} \text{ Å}$	8 × 10 <sup>-5</sup> Å	$-0.9 \times 10^{-6}$ Å
oxidation				
With Cu seed	$4 \times 10^{-5} \text{ Å}$	$-3.1 \times 10^{-6} \text{ Å}$	4 × 10 <sup>-5</sup> Å	$-1.5 \times 10^{-5} \text{ Å}$
and spacer				
oxidation				

Fig. 7

MAGNETIC COUPLING NCEMENT

Inventor: Choe, G.
ETHOD AND APPEATUS FOR PROVIDING PRECISE CONTROL MAGNETIC (
FIELD IN NIMM SPIN VALVE HEADS AND AMPLITUDE EXPONEMENT
Docket no.: SJ09-2001-0040US1 / 501.388US01 Serial Number 10/038,125

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800

Hf vs Cu spacer thickness

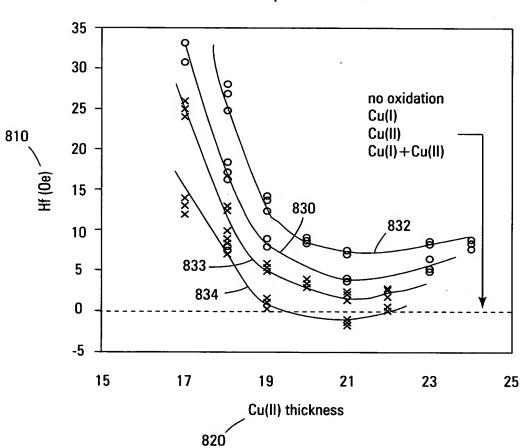


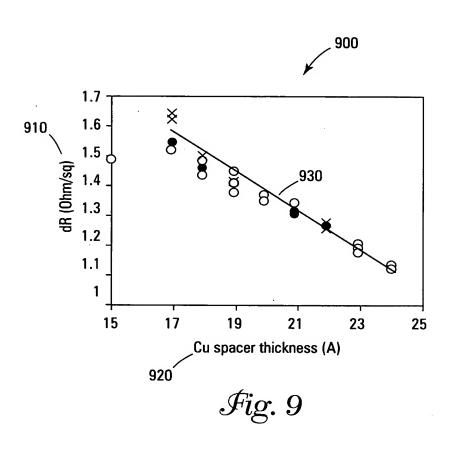
Fig. 8

Inventor: Choe, G.
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FIELD IN NIME SPIN VALVE HEADS AND AMPLITUDE EXPONEMENT
Docket no.: SJ09-2001-0040US1 / 501.388US01 Serial Number 10/038,125

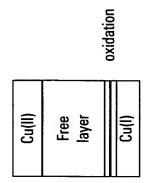
MAGNETIC COUPLING NCEMENT

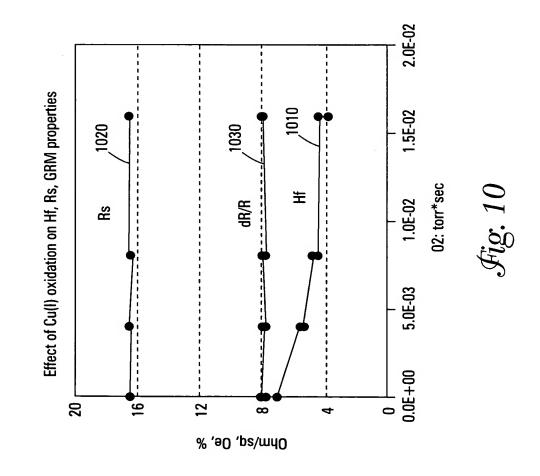
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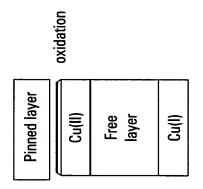
Inventor: Choe, G.
ETHOD AND APT ATUS FOR PROVIDING PRECISE CONTROL MAGNETIC OF FIELD IN NIME SPIN VALVE HEADS AND AMPLITUDE EXAMCEMENT Docket no.: SJ09-2001-0040US1 / 501.388US01 Serial Number 10/038,125 Title: A METHOD AND AP MAGNETIC COUPLING NCEMENT

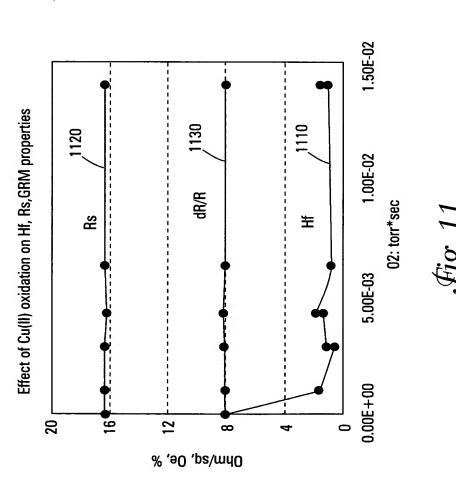




MAGNETIC COUPLING NCEMENT

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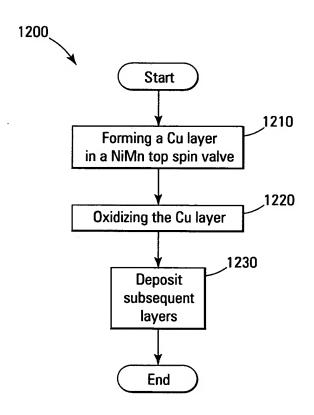


Fig. 12